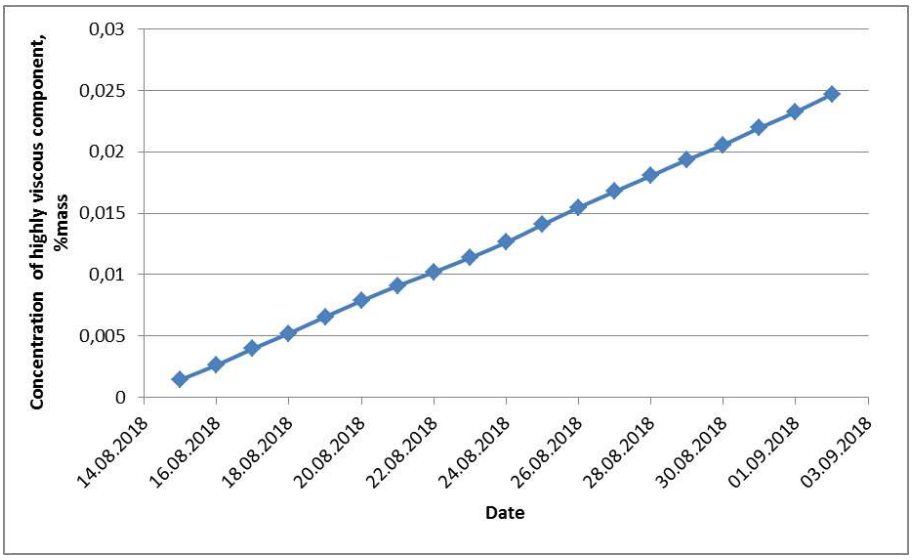

Fig 2. Dynamic of highly viscous component accumulation during one period between reactor washings

Thus, we can draw the conclusions that the developed model is adequate and able to calculate of the duration of period between reactor washings in the sulfonation reactor based on the accumulation of a high-viscosity component.

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DEVELOPMENT OF HEAVY OIL AND BITUMEN FIELDS WITH DIFFICULT CONSTRUCTION WELLS

N.I. Polyakova, A.A. Shupikov, E.M. Vershkova
National Research Tomsk Polytechnic University, Tomsk, Russia

High-viscosity oils and natural bitumen should be considered as a complex raw material. They include valuable organic compounds, including naphthenic acids, metal porphyrins, ethers and esters, which can serve as a source of unique catalysts, etc. They find application in medicine, in chemical technologies, in biotechnologies, therefore the question of development of deposits of heavy oils is especially actual.

Over two trillion barrels of viscous oil (heavy oil, extra heavy oil, and bitumen) are contained in naturally fractured carbonate rocks [4]. Mobile bitumen lies in sand and siltstone reservoirs, more viscous in carbonate. The basis for the cost-effective development of bitumen production can be the joint operation of natural bitumen deposits and ultra-viscous oil deposits located at a depth of 800-1200 meters.

Known methods of extraction of heavy oils and bitumen are characterized by high energy costs of thermal influence. The main complicating factors are the low permeability of bitumen-containing reservoirs and the viscosity of products exceeding 1000 mPa*sec. The capabilities of standard equipment for mechanized production do not meet the requirements of the high-viscosity oil deposits development due to the action of hydrodynamic friction forces during the movement of liquid in pipes. Therefore, there is an improvement of existing technologies and complication of well design.

It is known a method of the heavy oil and bitumen fields development by double-well horizontal wells is, which increases the efficiency of their development [3]. The method is: the opening of the productive formation is carried out by a horizontal trunk and its fastening by a casing flow string, previously equipped with a filter in the interval of the opened productive formation, the equipment of the wellhead, the installation of a blind packer through one wellhead in the interval of the productive formation of the well corresponding to the contour of watering, and the operation of the well through the second wellhead with the use of a pump.

Therefore, one of the wellheads of the well is used for thermal and chemical exposure or geophysical research and the second one – for production of hydrocarbons (fig.1). The complexity of monitoring the parameters of the steam chamber

(pressure and temperature along the well) makes it difficult to control the production process; the control parameters are the temperature of the supplied steam, the rate of pumping out the water-oil mixture, etc. [5].

The proposed approach makes it possible to create an extensive network of artificial channels that circulate the working agent in the production and injection wells in an impenetrable bitumen fields at the initial stage of development. Due to the closed artificial filtration channels of a double-well multilateral horizontal well for simultaneous production of hydrocarbons and injection of working agents, in particular thermal agent or solvent, the degree of hydrocarbon extraction increases.

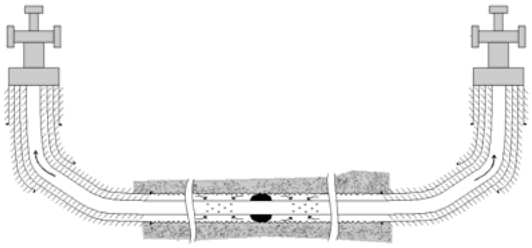

Fig. 1 Design of the double-well horizontal wells during operation

Another technology for the development of heavy oil and bitumen fields is the development of convective multilateral wells with the underlying hot water reservoir. It includes the construction of a well with numerous lateral sections to form a closed circulation between the layers; the formation of a thermal field in the lower layer and the selection of hydrocarbons from the upper layer; forced circulation of hot water from the lower layer and cooled from the upper [2] (fig. 2). The main technical results of the industrial use of the proposed method of extraction of viscous oils and bitumen is the use of hot formation water, which provides significant economic and environmental effects.

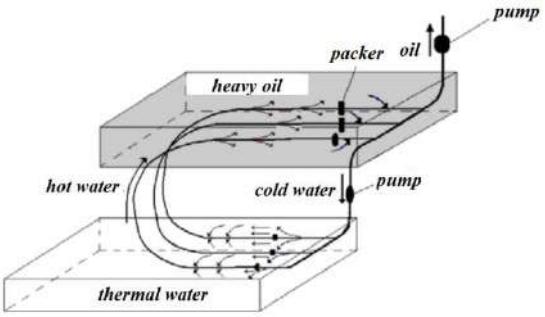

Fig. 2 Opening and exploitation of heavy oil and bitumen fields by convective well

Therefore, the reserves of heavy oil and natural bitumen are much bigger than the traditional oil reserves. Distribution of deposits of hard-to-recover raw materials in the world is quite wide. The development of low productive and inaccessible fields of hydrocarbons complicates the construction of the wells. Intelligent wells are needed in virtually every oil field, especially those with hard-to-recover reserves. In such a time of low oil prices, cost optimization will be the top priority for all the oil companies in the world [1].

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